

Diesel Off-road Equipment Measure - Workshop

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Air Resources Board

Overview

■ Introduction

■ Background

- ◆ Health Effects of Diesel PM
- ◆ Diesel Risk Reduction Plan
- ◆ ARB Diesel PM Control Measures

■ Off-Road Equipment Measure

- ◆ Equipment Affected
- ◆ Reduction Options/Verification
- ◆ Off-Road Activities
- ◆ Possible Approaches for Measure

■ Next Steps

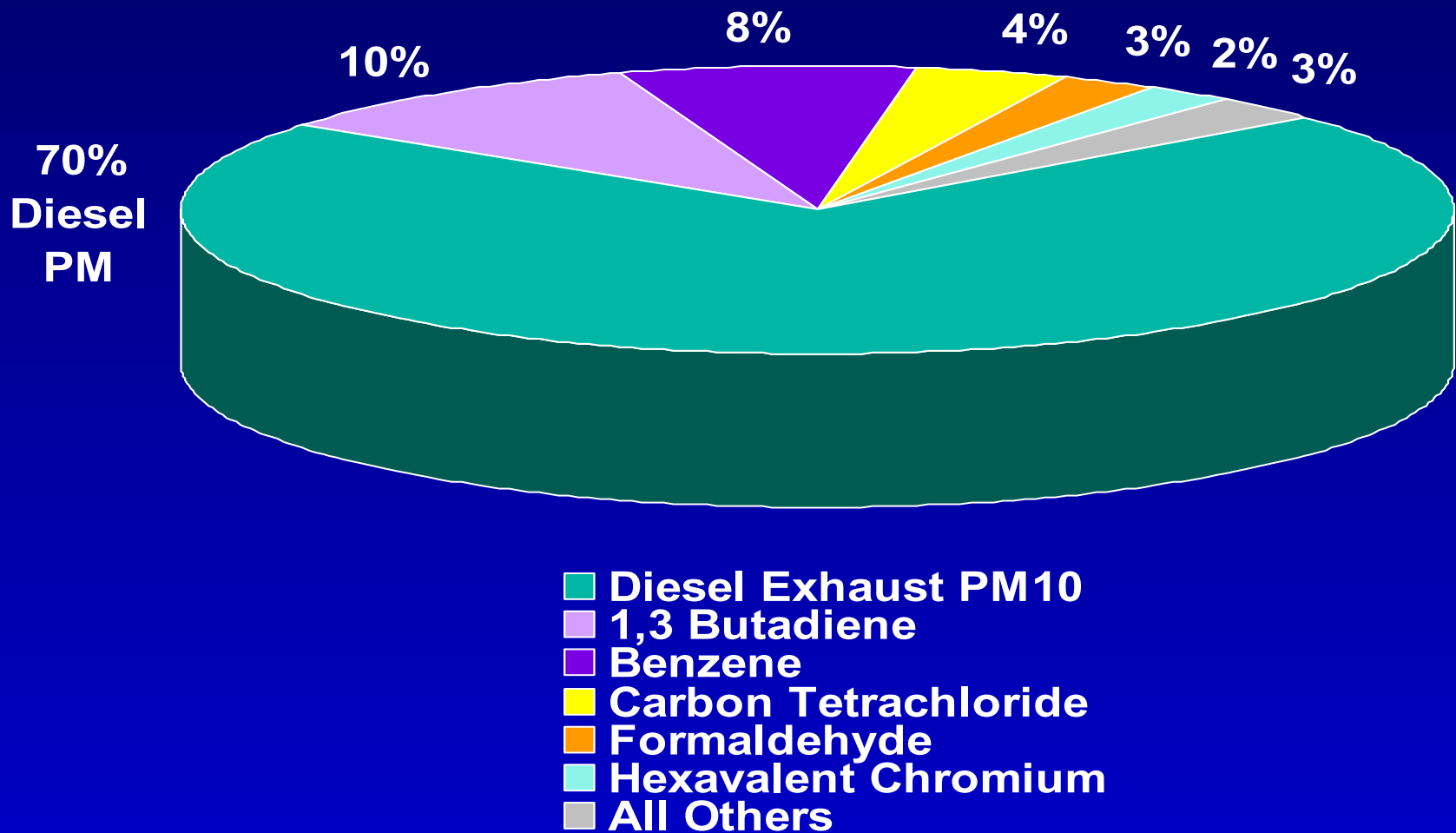
Introduction

- Why we are here
- Help we hope to get from stakeholders
 - ◆ Input on how to structure rule
 - ◆ Participation in workgroup(s)
 - ◆ Help with survey
 - ◆ Help identifying other stakeholders
- Products we will develop
 - ◆ Regulation
 - ◆ Staff report

Health Effects of Diesel PM

- **Increases Cancer Risk, Hospital Admissions & Premature Deaths**
- **In California in year 2000, diesel PM associated with:**
 - ◆ **2,000-2,500 annual premature deaths**
 - ◆ **~3,600 annual hospital admissions for pneumonia, cardiovascular disease, asthma, bronchitis**
- **By comparison, 3,700 deaths from car accidents, 2,000 homicides**

70% of Known Statewide Air Toxics Risk is from Diesel PM - Year 2000





California Diesel Risk Reduction Plan

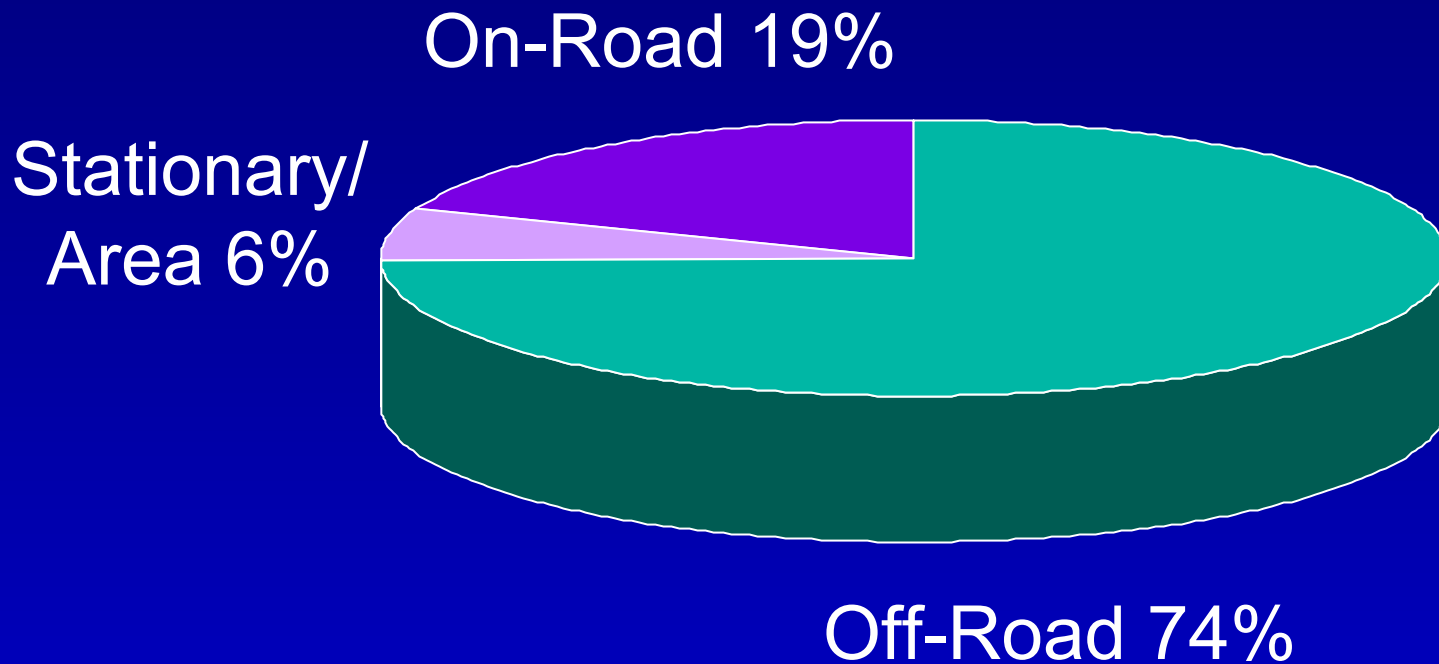
■ Established Goals

- ◆ Reduce PM emissions from all diesel-fueled engines in California
- ◆ 75% reduction by 2010
- ◆ 85% reduction by 2020

■ Four-pronged approach

- ◆ New engine standards
- ◆ Cleaner diesel fuel - <15 ppm S
- ◆ Retrofit of existing engines
- ◆ Ensure in-use emissions maintained

California Diesel PM - Year 2010



Adopted ARB Diesel Measures

- **Transit agency fleet rule (2/00)**
- **School bus idling (12/02)**
- **Airport Ground Support Equipment Memorandum of Understanding (12/02)**
- **Solid waste collection vehicles (9/03)**
- **Stationary CI engines (2/04)**
- **Portable engines (2/04)**
- **Transport Refrigeration Units (2/04)**
- **Commercial vehicle idling (7/04)**

Future ARB Diesel Measures

■ 2004-5

- ◆ Intrastate Locomotive/Commercial Harbor Craft Fuel**
- ◆ Transit Fleet Vehicles (Non Urban Buses)**
- ◆ Public On Road and Private Utilities**
- ◆ Cargo Handling Equipment (Ports and Intermodal Facilities)**
- ◆ Harbor Craft**
- ◆ Ship Auxiliary Engines**
- ◆ Stationary Agricultural Engines**

Schedule for Future ARB Diesel PM Measure Adoption Cont'd

■ 2006

- ◆ Off-Road Equipment (Public and Private)
- ◆ Private On-Road Trucks

■ 2007+

- ◆ Agricultural Off-Road Equipment

Off-Road Equipment Measure



Scope of Off-Road Equipment Rule

Category	PM, 2010, statewide [tpd]	# of Units
Construction & Mining	14.8	175,000
Industrial	0.8	8,500
Logging	0.4	2,800
Airport Ground Support Equipment (non South Coast, non-portable)	0.1	800
TOTAL	16.1	187,100

PM Reduction Options

■ Replacement

- ◆ Newer equipment meets cleaner standards

■ Repower

- ◆ Replacement engines are cleaner

■ Retrofit

- ◆ Verified technologies reduce emissions



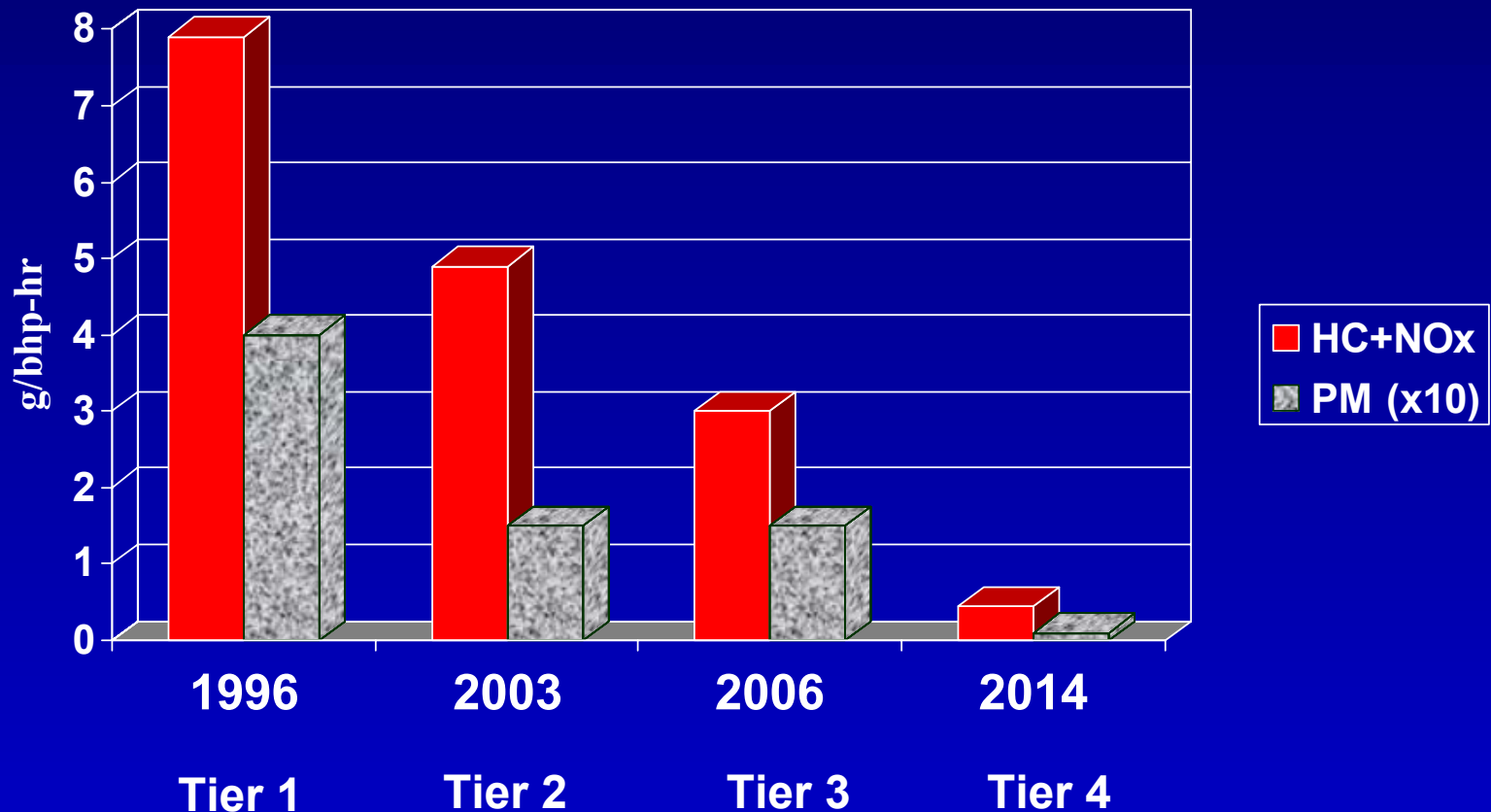
Uncontrolled

Controlled

Emission Standards for New Diesel Off-Road Engines

- **Becoming stricter over time**
- **Levels and effective dates depend on engine size (hp)**
 - ◆ **Tier 1: First effective in 1996-2000**
 - ◆ **Tier 2: First effective 2001-6**
 - ◆ **Tier 3: First effective 2005-8**
 - ◆ **Tier 4: First effective 2011-2015**
- **Low-sulfur diesel fuel (<15 ppm) required mid-2006**

Emission Standards for a 175 hp Diesel Engine



Potential Reduction Technologies

■ Exhaust Aftertreatment

- ◆ Passive and Active Diesel Particulate Filters (DPFs)
- ◆ Flow-thru Filters
- ◆ Diesel Oxidation Catalyst (DOC)
- ◆ Urea-SCR Catalyst

■ Fuels

- ◆ Fuel additives - fuel-borne catalysts
- ◆ Emulsified Fuels
- ◆ Biodiesel
- ◆ Fischer Tropsch

ARB Retrofit Verification Process

- Evaluates emission reduction capabilities of technology
- Ensures real and durable reductions
- 3 levels of verification:
 - ◆ Level 3 ($\geq 85\%$ PM reduction or ≤ 0.01 g/bhp-hr PM)
 - ◆ Level 2 ($\geq 50\%$ PM reduction)
 - ◆ Level 1 ($\geq 25\%$ PM reduction)

Current Verifications

■ Level 3

- Cleaire Flash & Catch CRT/DPX (**25% NOx ↓**)
- Cleaire Longview DPF + Lean NOx (**25% NOx ↓**)
- Clean Air Partners DPF
- CleanAIR Systems DPF (Stationary)
- Donaldson DPF
- Johnson Matthey CRT DPF
- Lubrizol ECS Purifilter DPF

Current Verifications Cont'd

■ Level 2

- Environmental Solutions Worldwide Flow Thru Filter
- Lubrizol PuriNOx (**15% NOx ↓**)
- Lubrizol PuriNOx/Purimuffler (**20% NOx ↓**, off-road intermodal facilities)

Current Verifications Cont'd

■ Level 1

- Cleaire Flash and Match (**25% NOx ↓**)
- Donaldson DOC
- Donaldson DOC + Spiracle
- Lubrizol ECS AZ Purifier & Purimuffler (off-road intermodal facilities)

Further Information on ARB Verification Process

- **For further info, see website**
<http://www.arb.ca.gov/diesel/verdev/verdev.htm>
- **Contact:**
**Scott Rowland, Manager, Retrofit
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Off-road PM Control Activities

■ Sacramento Air District Construction Mitigation



- ◆ Suggests 20% NOx↓ and 45% PM↓ from state average construction fleet emissions
- ◆ Has encouraged the use of newer construction equipment

Off-road PM Control Activities cont'd

■ San Luis Obispo Air District Construction Mitigation



- ◆ Best Available Control Technology for construction equipment
- ◆ Avila Beach Remediation - 12 DOCs, 3 DPFs on construction equipment
- ◆ Woodlands Housing Development - 12 DOCs on scrapers; repowered bulldozer

Off-road PM Control Activities cont'd

■ CIAQC 2003 Demonstration

- ◆ Joint effort by CIAQC, SCAQMD, ARB
- ◆ Retrofitted 18 heavy-duty construction vehicles
- ◆ DPFs on 24 engines

■ Boston Central Artery Tunnel “Big Dig”

- ◆ >100 pieces of construction equipment retrofitted with DOCs (cranes, lifts, excavators, bulldozers, etc.)
- ◆ Idling limits



Off-road PM Control Activities cont'd

- **World Trade Center Diesel Emissions Reduction Project**
- **New York City Construction Ordinance**
 - ◆ **Lower Manhattan, then all of New York City**
 - ◆ **Requires ultra-low S diesel fuel and best available PM control technology**
 - ◆ **Diesel off-road vehicles \geq 50 hp owned by or operated on behalf of the City**

Off-road PM Control Activities cont'd

■ Swiss Construction Retrofit Ordinance



- ◆ DPFs required for all construction equipment used at large construction sites
 - ✦ Equipment > 50 hp by 9/1/03
 - ✦ Equipment >= 25 hp by 9/1/05
- ◆ Over 6,000 construction machines have been retrofitted with DPFs

Off-road PM Control Activities cont'd

■ VERT Filter List

- ◆ VERT began in response to diesel PM problem in tunnel construction
- ◆ Joint German, Austrian, Swiss project
- ◆ Suitability testing and subsequent field tests for particle-trap systems

Possible Approaches for Off-Road Equipment Measure

- Accelerated turnover to cleaner engines
- Retrofit with Best Available Control Technology
 - ◆ Could include exhaust aftertreatment and/or alternate diesel fuels
- Idling limitations
- Registration, recordkeeping, reporting, and/or inspection

Next Steps for Off-Road Equipment Rulemaking

- Survey
- Workgroup
- More workshops to come in 2005
- Public hearing and consideration by Board in early 2006

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[http://www.arb.ca.gov/
msprog/ordiesel/ordiesel.htm](http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm)